Multipole physics for mode enhancement in photonic crystal taper

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Photonic crystal waveguides (PCWGs) have been a subject of much interest for guiding of light due to the presence of localized modes in the photonic bandgap. However, coupling to the photonic crystal waveguide poses a great challenge to many researchers due to it small size for applications in communication wavelength. Simple taper[1] structure has been design to be integrated with PCWG for coupling light effectively to the waveguide but have high losses due to back reflection, scattering and radiation mode coupling. Defects have been added to the taper structure to reduce these losses through mode enhancement for tapers. The physics behind the roles of defects is due to the multipole effect of the defects as a secondary oscillator source. The changes in charge distribution of the defects causes change the emission direction and angle. For this paper, the defects are tailored to change the emission directionality and angle through the change in geometry. This increases the coupling efficiency from 70% to 82% for mode conversion in simple taper.

[1] T. D. Happ, M. Kamp, and A. Forchel, Optics Letters, **26**, 1102 (2001).

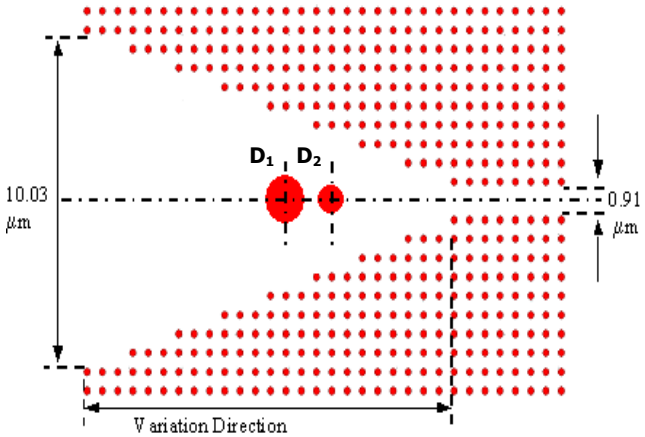

Figure 1: Schematic layout of the defects In a photonic crystal taper

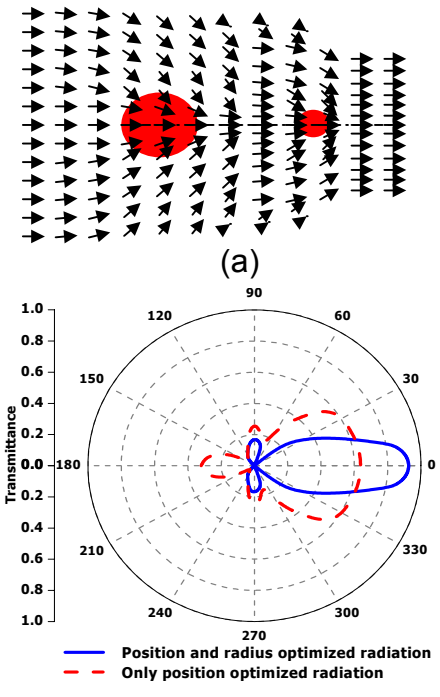

Figure 2: (a) Vector field plot (b) Polar plot of the defects as a secondary oscillator source